This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A method for forming an image model, comprising the steps of:

developing acoustic properties for a medium based on variation of a point-scatterer representation of the medium microstructure;

developing gross shape based on the variation of the medium microstructure;

developing imaging system characteristics; and

~~developing microstructure; and~~

incorporating the imaging system characteristics, the gross shape, and the variation of the medium microstructure to form the image model. ~~, wherein the image model includes a data likelihood enabling a statistical inference to formulate underlying characteristics, and the data likelihood is constructed as a product of density functions characterizing each pixel.~~

2. (Currently Amended) The method of claim 1, wherein the image model includes a data likelihood enabling a statistical inference to formulate underlying characteristics, wherein the data likelihood is constructed as a product of density functions characterizing each pixel, and wherein the density function characterizing each pixel is assigned to each pixel based upon a classification of each pixel determined by a ratio of an amplitude mean value and a standard deviation value.

3. (Previously Presented) The method of claim 1, wherein the gross shape is described by a triangulated surface and acoustic properties of the triangulated surface are represented by multiple discrete scatterers distributed across the triangulated surface in a random model.

4. (Previously Presented) The method of claim 3, wherein spatial locations of the scatterers across the triangulated surface are parametrized by a scatterer concentration and a surface roughness.

5. (Previously Presented) A method for forming an image model, comprising the steps of:

developing imaging system characteristics;

developing gross shape;

developing microstructure; and

incorporating the imaging system characteristics, the gross shape and the microstructure to form the image model, wherein:

the image model includes a data likelihood enabling a statistical inference to formulate underlying characteristics;

the data likelihood is developed using image pixel based statistics and comprises the steps of:

a. computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean value to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;

b. classifying each pixel as Rayleigh or Gaussian determined by the ratio of the amplitude mean value to the standard deviation value;

c. assigning a density function to each image pixel based upon the classification of each image pixel; and

d. constructing the data likelihood as a product of the density functions.

6. (Original) The method of claim 5, wherein constructing the data likelihood assumes an independence between each image pixel.

7. (Original) The method of claim 5, wherein the image model is physically-based and the order of the steps permits inclusion of the imaging system characteristics, the gross shape and the microstructure at each image pixel without violating the physical image model.

8. (Original) The method of claim 5, wherein computation of the amplitude mean and the amplitude variance value is non-trivial, requiring calculation of multiple integrals for each pixel.

9. (Original) The method of claim 5, wherein the density function describes an echo amplitude of a respective image pixel.

10. (Original) The method of claim 5, wherein the data likelihood is suitable for performing pose estimation.

11. (Original) The method of claim 1, wherein the imaging system characteristics are described by a point spread function.

12. (Original) The method of claim 1, wherein tissue is characterized by a reflectivity function.

13. (Previously Presented) A method for forming an image model, comprising the steps of:

developing imaging system characteristics;

developing gross shape;

developing microstructure; and

incorporating the imaging system characteristics, the gross shape and the microstructure to form the image model, wherein tissue is characterized by a reflectivity function that comprises a sum of scaled three-dimensional delta functions.

14. (Previously Presented) A method for forming an image model, comprising the steps of:

creating a physical model of image formation; and

creating a random phasor sum representation of the physical model to form the probabilistic model.

15. (Previously Presented) The method of claim 14, wherein creating the physical model of image formation comprises the steps of:

forming imaging system characteristics;

forming microstructure; and

incorporating the imaging system characteristics and the microstructure to create the physical model.

16. (Original) The method of claim 1, wherein the gross shape is described by a triangulated surface.

17. (Original) The method of claim 16, wherein the triangulated surface includes a set of triangular elements defined by respective vertices and edges of the triangular elements.

18. (Previously Presented) A method for forming an image model, comprising the steps of:

creating a physical model of image formation; and

creating a representation of the physical model to form the probabilistic model, wherein the representation is a data likelihood created from a random phasor sum representation of the physical model.

19. (Previously Presented) The method of claim 18, wherein the data likelihood enables a statistical inference to formulate underlying characteristics.

20. (Previously Presented) The method of claim 18, wherein the data likelihood is constructed using image pixel statistics by assigning a density function to each image pixel and constructing the data likelihood as a product of the density functions.

21. (Previously Presented) The method of claim 20, wherein constructing the data likelihood further comprises:

computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean value to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;

classifying each pixel as Rayleigh or Gaussian determined by the ratio of the amplitude mean value to the standard deviation value;

assigning the density function to each image pixel based upon the classification of each image pixel;

22. (Canceled)

23. (Currently Amended) A method for forming a physically-based, probabilistic model for ultrasonic images, comprising the steps of:

creating a representative physical model of image formation, including formulating gross medium shape based on variation of a point-scatterer representation of a microstructure of the medium; and

creating a representation of the physical model to form the probabilistic model. ~~, wherein a data likelihood is created enabling a statistical inference to formulate underlying characteristics, the data likelihood constructed as a product of density functions characterizing each pixel.~~

24. (Previously Presented) A method for forming a physically-based, probabilistic model for ultrasonic images, comprising the steps of:

creating a physical model of image formation; and

creating a representation of the physical model to form the probabilistic model, wherein the representation is a random phasor sum representation resulting from a linear model of a radio frequency image portion of the physical model, the radio frequency image portion being characterized by a point spread function.

25. (Original) The method of claim 24, wherein tissue is characterized in the radio frequency image portion by a reflectivity function.

26. (Original) The method of claim 25, wherein tissue is characterized in the radio frequency image portion by a discrete scatterer model.

27. (Original) The method of claim 26, wherein the discrete scatterer model includes multiple discrete scatterers distributed across a surface of the gross shape.

28. (Original) The method of claim 27, wherein spatial location of the discrete scatterers distributed across the surface is parametrized by a scatterer concentration and a surface roughness.

29. (Original) The method of claim 27, wherein each discrete scatterer is a sub-wavelength perturbation in the surface that scatters strongly in the direction of a transducer.

30. (Original) The method of claim 27, wherein each discrete scatterer contributes a phasor to the random phasor sum representation of the physical model.

31. (Currently Amended) The method of claim 23, wherein the image model includes a data likelihood enabling a statistical inference to formulate underlying characteristics, wherein the data likelihood is constructed as a product of density functions characterizing each pixel, and wherein the density function characterizing each pixel is assigned to each pixel based upon a classification of each pixel determined by a ratio of an amplitude mean value and a standard deviation value.

32. (Previously Presented) A method for forming a physically-based, probabilistic model for ultrasonic images, comprising the steps of:

creating a representative physical model of image formation wherein creating the physical model includes:

forming imaging system characteristics;

forming shape; and

forming microstructure using image pixel-based statistics comprising the steps of:

a. computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;

b. classifying each image pixel as Rayleigh or Gaussian depending on the ratio of the amplitude mean to the standard deviation value;

c. assigning a density function to each image pixel based upon the classification of each image pixel; and

d. constructing the data likelihood as a product of the density functions; and

incorporating the imaging system characteristics, the shape and the microstructure to create the physical model; and

creating a representation of the physical model to form the probabilistic model.

33. (Previously Presented) A method for forming a physically-based, probabilistic model for ultrasonic images, comprising the steps of:

a. creating a representative physical model of image formation, including:

i. formulating a deterministic description of imaging system characteristics,

ii. formulating a deterministic description of gross shape,

iii. formulating a random description of microstructure, and

iv. incorporating the imaging system characteristics, the gross shape and the microstructure to form the model; and

b. creating a random phasor sum representation of the physical model to form the probabilistic model.

34. (Cancelled)

35. (Currently Amended) A computer readable medium that configures a computer to perform a method that forms a physically-based, probabilistic model for ultrasonic images, the method comprising the steps of:

creating a representative physical model of image formation, including formulating gross medium shape based on variation of a point-scatterer representation of a microstructure of the medium; and;

creating a representation of the physical model to form the probabilistic model. ~~, wherein a data likelihood is created enabling a statistical inference to formulate underlying characteristics, the data likelihood constructed as a product of density functions characterizing each pixel.~~

36. (Previously Presented) A computer readable medium that configures a computer to perform a method that forms a physically-based, probabilistic model for ultrasonic images, the method comprising the steps of:

creating a representative physical model of image formation; and

creating a representation of the physical model to form the probabilistic model, wherein the representation is a random phasor sum representation resulting from a linear model of a radio frequency image portion of the physical model, the radio frequency image portion being characterized by a point spread function.

37. (Original) The computer readable medium of claim 36, wherein tissue is characterized in the radio frequency image portion by a reflectivity function.

38. (Original) The computer readable medium of claim 37, wherein tissue is characterized in the radio frequency image portion by a discrete scatterer model.

39. (Original) The computer readable medium of claim 38, wherein the discrete scatterer model includes multiple discrete scatterers distributed across a surface of the gross shape.

40. (Original) The computer readable medium of claim 39, wherein spatial location of the discrete scatterers distributed across the surface is parametrized by a scatterer concentration and a surface roughness.

41. (Original) The computer readable medium of claim 39, wherein each discrete scatterer is a sub-wavelength perturbation in the surface that scatters strongly in the direction of a transducer

42. (Original) The computer readable medium of claim 39, wherein each discrete scatterer contributes a phasor to the random phasor sum representation of the physical model.

43. (Cancelled)

44. (Previously Presented) A computer readable medium that configures a computer to perform a method that forms a physically-based, probabilistic model for ultrasonic images, the method comprising the steps of:

creating a representative physical model of image formation; and

creating a representation of the physical model to form the probabilistic model, wherein the probabilistic model is formed using image pixel-based statistics comprising the steps of:

a. computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;

b. classifying each image pixel as Rayleigh or Gaussian depending on the ratio of the amplitude mean to the standard deviation value;

c. assigning a density function to each image pixel based upon the classification of each image pixel; and

d. constructing a data likelihood as a product of the density functions.

45. (Currently Amended) A computer readable medium that configures a computer to perform a method that forms an image model, the method comprising the steps of:

<u>developing acoustic properties for a medium based on variation of a point-scatterer representation of the medium microstructure;</u>

<u>developing gross shape based on the variation of the medium microstructure;</u>

developing imaging system characteristics; and

~~developing sub-wavelength microstructure;~~

incorporating the imaging system characteristics, the gross shape, and the variation of the medium microstructure to form the image model. ~~, wherein the image model includes a data likelihood enabling a statistical inference to formulate underlying characteristics, and the data likelihood is constructed as a product of density functions characterizing each pixel.~~

46. (Previously Presented) A computer readable medium that configures a computer to perform a method that forms a physically-based, probabilistic model for ultrasonic images, the method comprising the steps of:

a. creating a representative physical model of image formation, including:

i. formulating a deterministic description of imaging system characteristics,

ii. formulating a deterministic description of gross shape,

iii. formulating a random description of microstructure, and

iv. incorporating the imaging system characteristics, the gross shape and the microstructure to form the model; and

b. creating a random phasor sum representation of the physical model to form the probabilistic model.

47. (Previously Presented) A computer readable medium that stores a program to form a physically-based, probabilistic model for ultrasonic images, the program comprising:

a. means for creating a representative physical model of image formation; and

b. means for creating a random phasor sum representation of the physical model to form the probabilistic model, wherein the representation is a data likelihood created from the random phasor sum representation of the physical model.

48. (Previously Presented) A computer readable medium that stores a program to form an imaging model, the program comprising:

means for forming imaging system characteristics; and

means for forming-microstructure; and

means for incorporating the imaging system characteristics and the microstructure to create the imaging model, wherein the image model includes a data likelihood enabling a statistical inference to formulate underlying characteristics, and the data likelihood is constructed as a product of density functions characterizing each pixel.

49. (Original) A computer readable medium that stores a program to perform image pixel based statistics, the program comprising:

a. means for computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean to a standard deviation value at each image pixel to develop a statistical image characterizing tissue;

b. means for classifying each image pixel as Rayleigh or Gaussian depending on the ratio of the amplitude mean to the standard deviation value;

c. means for assigning a density function to each image pixel based upon the classification of each image pixel; and

d. means for constructing the data likelihood as a product of the density functions.

50. (Previously Presented) A computer readable medium that stores a program to form a physically-based, probabilistic model for ultrasonic images, the program comprising:

a. means for creating a representative physical model of image formation, including:

i. means for developing a deterministic description of imaging system characteristics,

ii. means for developing a deterministic description of gross shape,

iii. means for developing a random description of microstructure, and

iv. means for incorporating the imaging system characteristics, the gross shape and the microstructure to form the physical model; and

b. means for creating a random phasor sum representation of the physical model to form the probabilistic model.

51. (Currently Amended) The method of claim 1, ~~further comprising the step of developing gross shape,~~ wherein the gross shape is described by a volume of space.

52. (Previously Presented) The method of claim 51, wherein acoustic properties of the volume of space are represented by multiple discrete scatterers distributed across the volume.

53. (Previously Presented) The method of claim 1, wherein the image model is used to estimate a temperature of an object imaged.

54. (Previously Presented) The method of claim 1, wherein the image model is used to estimate a shape of an object imaged.